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Reviews of Foreign Literature.

A Contribution to our Knowledge of Seedlings. By Sir John Lubbock, Bart., M. P., F. R. S., D. C. L., LL. D. (Kegan Paul, Trench, Trübner & Co., London, 1892).

Sir John Lubbock has in this work made a very important contribution to our knowledge of plants. The work occupies a field which has heretofore received comparatively little attention. Works upon systematic botany have been compiled repeatedly, until now Bentham and Hooker's "Genera Plantarum" may fairly be supposed to include nearly all the forms of spermatophytes entitled to stand as genera. In the meantime there remains much to be done in the way of research upon the life-histories of these plants, especially upon the structure of the embryo and its germination. It is into this field that Sir John Lubbock has pushed with characteristic vigor, and the result is this work "On Seedlings" in two volumes, and each volume of over 600 pages.

In the short preface the author briefly states the subject of his work, and mentions those who have assisted him in it. The first 77 pages are devoted to an introduction consisting of generalizations upon the several parts of the embryo both before and during germination. Following this are about 1119 pages, devoted, 1st, to seeds and their germination in the order as a whole, and 2d, a detailed description of the seed, their germination, and the seedlings of the species studied in the order. Species representing nearly every order in Bentham and Hooker's "Genera Plantarum" were studied. The arrangement of orders is the same as in that work, of which, indeed, this work on seedlings might well be considered a fitting supplement. The following are the orders in which the largest number of species were studied: Ranunculaceæ, 26 species; Cruciferæ, 57 sp.; Malvaceæ, 26 sp.; Leguminosæ, 95 sp.; Rosaceæ 22 sp.; Onagrarieæ, 20 sp.; Compositæ, 91 sp.; Labiatæ, 25 sp. A third part of the work is devoted to the bibliography of the subject in two divisions, 1st, general; 2d, special. Finally, a full index is appended.

The introduction is the part of the work that will excite most attention. Many facts are incorporated in it which have already been recorded, especially that part of the descriptions which detail the development and structure of the ovule and the position of the parts of the embryo in the seed; yet the author has ventured to go farther than anyone before him, and has pointed out just how different forms of embryo have originated. This gives to the old facts a new charm. As the author informs us on the first page, these propositions have already been made in the "Jour. Linn. Soc. Vols. xxii.-xxiv.," and as he now reprints them, we feel assured that his confidence in his own interpretation of nature is not shaken by subsequent observation and reflection. All may not agree with him in his interpretations, but no one can question his accuracy of observation. It remains for his critics to draw conclusions which will harmonize better with the facts. Some of these propositions may be profitably mentioned.

1. The inversion of the ovule is of advantage to the plant in that it brings the micropyle in such a position as to increase the probability of fertilization. Here the author confirms the conclusions of others and promises "to enter into the question more fully on a future occasion." The writer of this review has suggested an entirely different explanation of this modification of the ovule and seed, i. e., that it is due to the advantage gained by the correlation of the parts of the embryo, to the external appendages of the seed, thereby securing a favorable position for the embryo during germination. (See "Science Vol. xx. No. 504, September 30, 1892.")

2. Unequal, unsymmetrical, lobed, and auricled cotyledons are to be explained by the crowding of the embryo in the seed, and its tendency to occupy all the available space within the coats.

3. The position of the embryo is often changed to accommodate its parts to the form of the seed. Embryos with accumbent and incumbent parts are, in many cases, thereby explained. "Now if from the form of the pods, or for any other reason, it is an advantage that the seed should be compressed, then the thickness of the cotyledons remaining the same, it is better that the radicle should be accumbent; while on the other hand, in a thicker or globular seed the incumbent arrangement is most convenient." In general, the author believes that the form of the seed determines the form of the embryo.

4. It seems desirable that the cotyledons should be raised above the surface of the ground. This leads to a correspondence between the length of the hypocotyl and the length of petiole of the coty-

ledons. The general rule is then "that the cotyledons are sessile when they are raised by the growth of the hypocotyl, while they are petiolate when they take their origin close to the ground." Connate petioles serve the purpose of forming a stronger support for the cotyledons than would be afforded if they remained separate.

5. Narrowness of the cotyledons or their division into narrow segments is attributed to the greater facility with which they may be withdrawn from the seed-coats. Also, narrowness of the cotyledons in some cases "enables the plant to make them lie conveniently in a globose seed."

The generalizations with which each order is introduced, are especially interesting and valuable. Here, as well as in the description of each species, the cotyledons are given prominence. The Onagrarieæ is as fair a choice among the orders as could be made. The seedlings of quite a number of its species have cotyledons in which a secondary growth occurs. The seedlings of *Œnothera Bistorta* are described as follows:

"Immediately after germination the cotyledons are oblong, obtuse, entire, sessile with a few long, scattered, glandular hairs, especially at the base. Hypocotyl with a few glandular hairs at the apex. Cotyledons often unequal, owing to their greater or less development in the seed, and one folding over the other.

"Six days after germination the base has become elongated, petiole-like, and glandular-pubescent, suddenly narrowed to a short petiole, or subsessile; the upper half remains rotund and glabrous except at the base and possibly a few short hairs underneath.

"Eight days after germination (fig. 367) they have elongated considerably, the upper true cotyledonary part enlarging, but otherwise remaining unaltered, while the foliar basal and narrow part has become linear, entire or sometimes with a minute tooth on either side, glandular-pubescent, suddenly narrowed at the very base.

"The lower portion elongates greatly, and the ultimate stage of the cotyledons (fig. 368) is linear, tapering at the base into a petiole; upper part or true cotyledon rotund or oval, entire glabrous, very short without midrib, lower part linear terminating abruptly in the upper part, tapering gradually to the base, with one or two minute and distant teeth on each side, thinly hairy, greyish-green with an evident midrib sunk on the upper surface, and prominent beneath; petiole subterete, flattened above, very thinly hairy, or at length nearly glabrous.

"First eight leaves radical, alternate, linear, obtuse, tapering at the base into the petiole, thinly silky with appressed pubescence, minutely and distantly toothed at the margin, greyish green, more or less distinctly marked near the margin with black dots, with a very distinct, colorless mid-rib, flattened above, thinly hairy at the margins, colorless. (Thirty-four days after germination.)"

One of the striking features of the volumes to students especially interested in American plants, is the small number of North American species studied. Descriptions of seedlings of several garden vegetables are included. Among these, most prominent, perhaps, are the common radish (*Raphanus sativus*), common bean (*Phaseolus vulgaris,* tomato (*Lycopersicum esculentum*) and pepper (*Capsicum* sp.). Seedlings of many cultivated ornamental species are studied. Many of the species are rarely seen outside of Kew Gardens.

The author uses the old term "radicle" as a name for the axis of the embryo while in the seed, but steadily applies the word "hypocotyl" to the same organ during germination. The beginnings of the root-system of the plant is scarcely touched upon, although the origin of the first roots have been shown by Holm (Mem. Torr. Bot. Club. Vol. ii. No. 3) to determine in a considerable measure the habit of the plant.

The volumes are profusely illustrated with outline sketches.

All will agree, I think, that more such books are needed. It is only when as careful researches are made upon the life-histories of seed producing plants, as cryptogamic botanists find themselves obliged to make upon the lower plants, that we shall discover how much yet remains to be done to complete our knowledge of the Spermaphytes. There are many fields as inviting as was the one chosen by Sir John Lubbock. W. W. ROWLEE.

On the Simplest Form of Moss. Karl Goebel. (Ann. Bot. vi. 355–360, Plate XXII. 1892).

The author considers *Buxbaumia* an almost ideally simple moss, because the sexual organs are borne almost directly on the protonema, in this approaching the ferns. The protonema is said to be similar to that of certain species of *Trichomanes*, and is compared with that of *Sphagnum*, *Andreæa* and *Metzgeriopsis*. The sporogonium is said to be most nearly allied to that of *Diphyscium*, and to possess no true seta, as the calyptra is ruptured by the expansion of the theca, and not by the elongation of the pedicel, as in the true Bryineæ. The plate illustrates the variation of the sporophylls in *Onoclea Struthiopteris*, and *Botrychium Lunaria*. The alliance with *Diphyscium* is contrary to the views of Lindberg and Braithwaite, though more in harmony with those of all the older authors, and most modern ones. Also the growth of the sexual organs upon the protonema, and the complexity and variability of the peristome would seem rather to indicate a higher organization.

The paper noticed above abounds in theories of the most slender probability, stated as ascertained facts. For example, in a paragraph of eleven lines (p. 357) the following propositions are given.

1. The organization of the sporogonium of *Buxbaumia* "is rudimentary as compared with that of the true Bryineæ."

2. "It somewhat recalls that of *Sphagnum* and *Andreæa*."

3. "It has no true seta, but merely an absorbent organ which penetrates into the rudimentary stem of the moss-plant."

4. "This organ gives off a number of rhizoids which absorb nourishment from the stem."

5. "Consequently in this form the calyptra is ruptured, not by the elongation of the seta as in the Bryineæ, but by the expansion of the theca of the sporogonium."

As Professor Goebel gives no reasons for his inferences, discussion is out of the question. The apparent statements of fact are contrary to the conditions observed in a recent study of *Buxbaumia*, which gives, in the main, the same results as those of Schimper, from whose descriptions and plates it appears that the capsule (especially of *B. indusiata*) is, if anything, the most complex of any of the mosses; the seta is entirely homologous with that of other mosses, does not give off rhizoids, but fits into a socket of the short stem, and ruptures the calyptra by elongation.

The fact that the marginal cells of the leaves of *Buxbaumia* grow out into long filaments is given as a reason for supposing hat the leaves of this genus are in some way more *protonemal* than those of other mosses, regardless of the facts that *B. Favanica* has entire leaves, and that there are plenty of instances among mosses and hepaticæ where the marginal cells and even those of other parts of the leaf are produced into cilia. Indeed, Professor Goebel seems here to have undertaken a gratuitous labor, for all are agreed that the plant body in mosses and foliose hepaticæ grows from the protonema. The peculiarity of *Buxbaumia* in the respect seems to be that it does not grow so large.

The strangest thing about *Buxbaumia* is, perhaps, its physiological arrangement. The sexual generation, instead of leading the life of a parasite upon its parent, as in other mosses, is richly provided with chlorophyll, and apparently needs the parent only as a means of attachment to the substratum. O. F. COOK.

Bulletin de l'Herbier Boissier. Sous la Direction de Eugène Autran, Conservateur de l' Herbier. (Tome i. No. 1, 8vo. pp. 32, avec deux planches, Geneve, 1893).

We chronicle with much pleasure and interest, the appearance of another new journal, published under the auspices of the great herbarium of M. Boissier at Chambesy, near Geneva. It is planned to issue the Bulletin as material becomes available, and to produce a volume of 400 pages each year. The first number contains two papers: (I) Les Genres *Achatocarpus*, Triana et *Bosia*, L., et leur Place dans le Systeme Naturel by Dr. Hans Schinz and M. Autran, illustrated by two plates. *Achatocarpus* is a South American genus placed by Triana in relationship with *Rivina* in the Phytolacaceæ, where MM. Schinz and Autran conclude it belongs. It is referred by Bentham and Hooker to the Amarantaceæ and by Baillon to the Chenopodiaceæ. Four new species are described, all Paraguayan.

The second paper is by Dr. Geo. E. Post, and is Part V. of his descriptions of and notes on Syrian plants. N. L. B.

Proceedings of the Club.

TUESDAY, FEBRUARY 14TH, 1893.

The President in the chair and thirty-five persons present.

Mrs. L. Brück, of Hoboken, N. J., and Mr. Geo. M. Beringer, of Camden, N. J., were elected active members.